Spicer® Drive Axles

SPICER®

DANA

Service Manual

Spicer® Drive Axles

AXSM-8810

January 1998

G155-T, G175-T, M190-T
M210-T, M220-T, M230-T
Two Speed Axles

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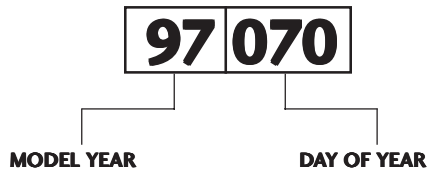
GENUINE SPICER SERVICE PARTS

Should an axle assembly require replacement component parts, it is recommended that Spicer Heavy Axle Service Parts be used. Spicer Heavy Axle Service Parts are manufactured under the same rigid specification as are original equipment axle components. This assures the customer who uses genuine Spicer service parts, maximum reliability for a Spicer Heavy Axle assembly. They may be obtained through your vehicle manufacturer. The use of non-original Spicer service parts may cause premature component failure and may void the warranty.

The items included in this book are currently being offered as service parts at the time of printing. The part numbers and illustrations are provided specifically for reference purposes only. Therefore, Spicer reserves the right to update this manual without notice or liability.

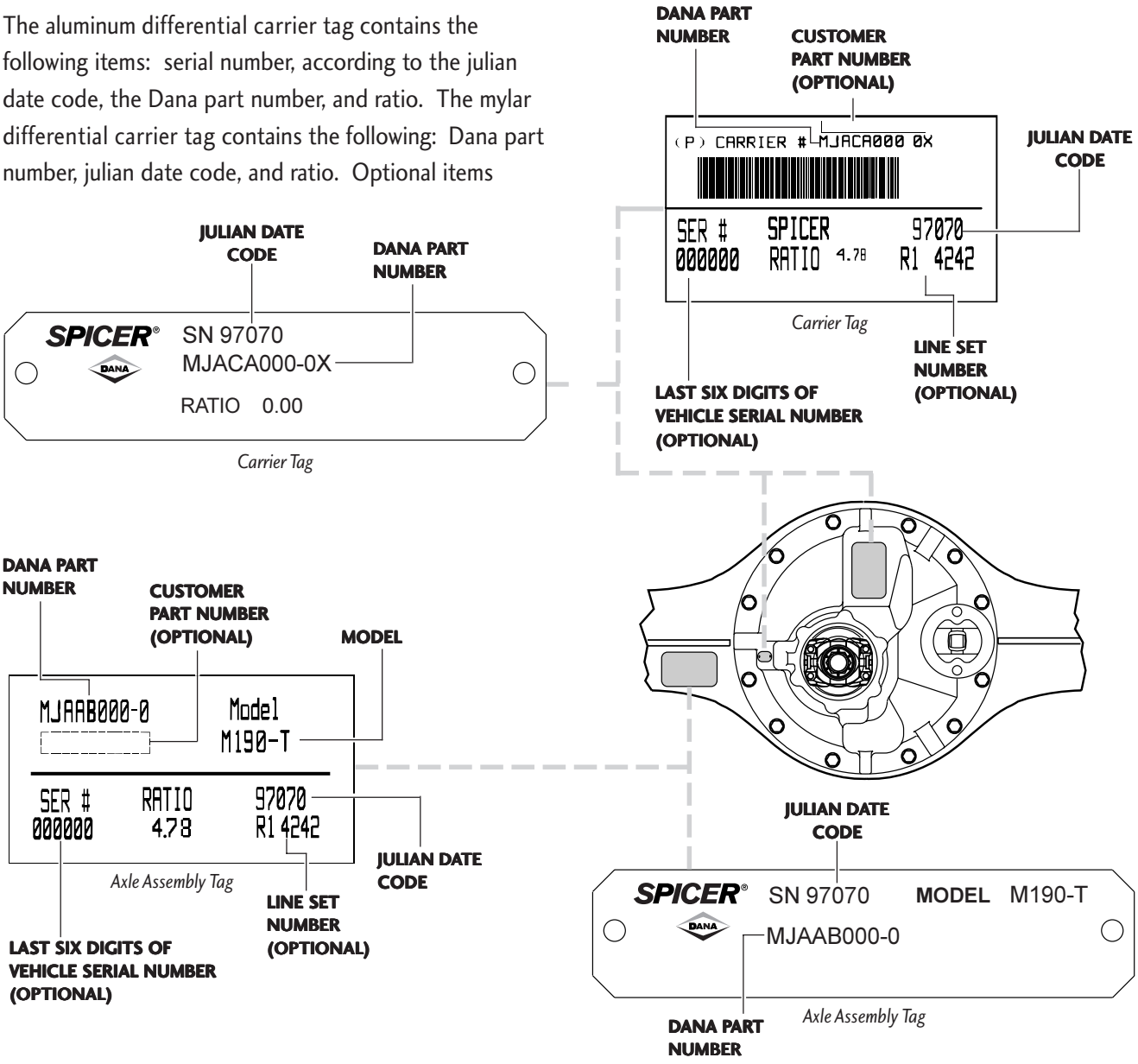
JULIAN DATE CODE



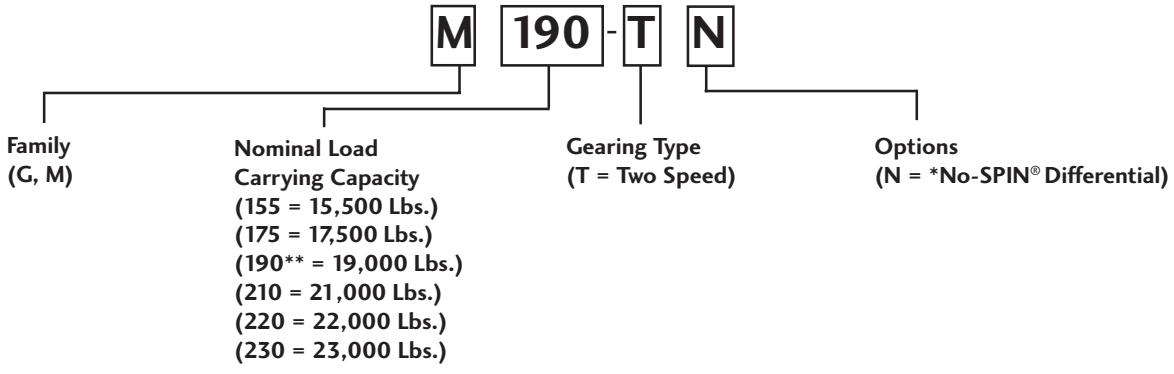
All axle assemblies are identified with two tags. One located on the differential carrier, and the other located on the right hand side of the axle housing. Two types of tags may be found on the axle, an aluminum tag that is riveted on the axle assembly or a coated mylar tag.

The aluminum differential carrier tag contains the following items: serial number, according to the julian date code, the Dana part number, and ratio. The mylar differential carrier tag contains the following: Dana part number, julian date code, and ratio. Optional items include customer part number, line set number, and the last six digits of the vehicle serial number.

The aluminum axle assembly tag contains the following items: serial number, according to the julian date, Dana part number, and the model. The mylar axle assembly tag contains the following items: Dana part number, julian date code, axle model, and ratio. Optional items include customer part number, line set number, and the last six digits of the vehicle serial number.

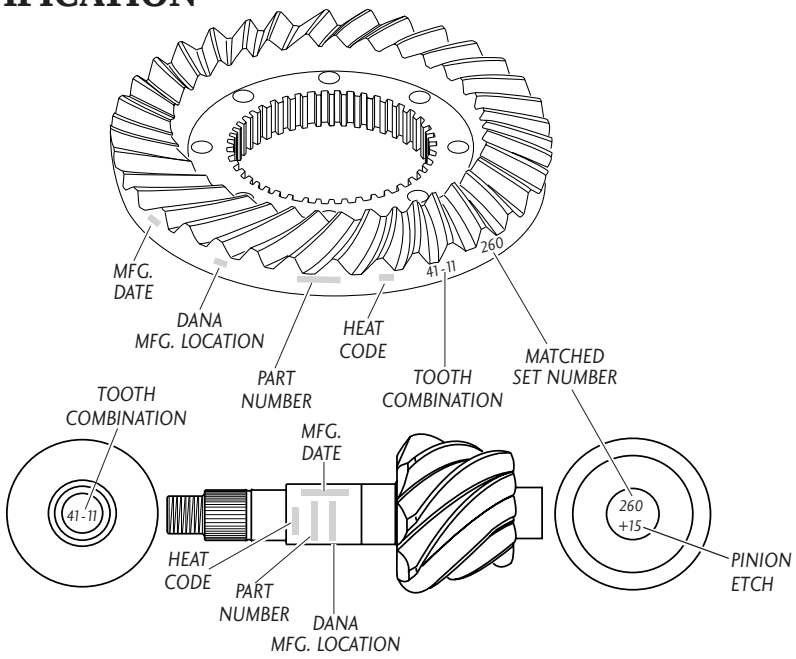


MODEL IDENTIFICATION NUMBERING SYSTEM



** No-SPIN® is a registered trademark of Tractech*
*** Same as 185 = 18,500 Lbs.*

GEAR SET IDENTIFICATION



Manufacturer's Date- Date gear set was made.

Spicer Trademark- Company logo and location of manufacturing facility.

Part number- Ring Gear (GGAGR104 TYPICAL)

Tooth Combination(i.e. 41 - 11) - Indicates the pinion has 11 teeth and the ring gear has 41 teeth which results in a 3:73:1 ratio.

Matched Set Number- Spicer ring gears and pinions are manufactured as matched sets. Both ring gear and pinion are marked with a corresponding number (i.e. 260), which identifies them as a matched set.

A gear set that does not have the same match set numbers should not be run together. If either ring gear or pinion require replacement, a new matched set must be used.

Backlash Etch- Indicates backlash setting for assembly.

Pinion Etch- Indicator for proper pinion position shim stack up. See Pinion Position Section.

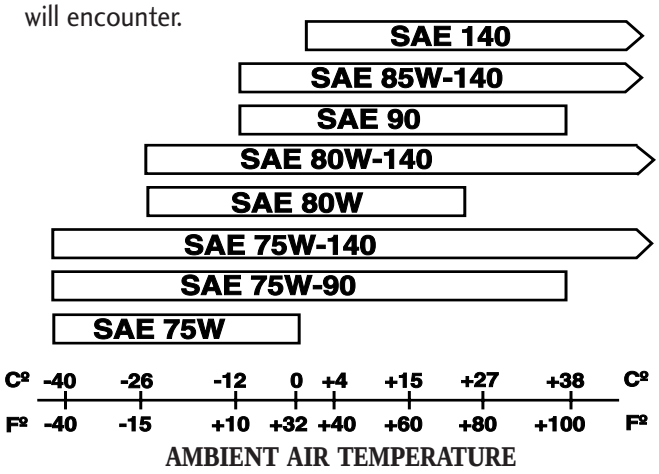
AXLE LUBRICANT RECOMMENDATIONS

To ensure proper lubrication and operating temperature, correct lubricants and lubricant levels must be obtained.

RECOMMENDED GEAR LUBRICANTS

Mineral or Synthetic based hypoid gear lubricants that meet or exceed military specification MIL-L-2105D, and API service classification GL-5, are the minimum requirements for use in Spicer Medium and Heavy Duty Drive Axles.

The table below indicates which SAE viscosities are recommended for various temperature ranges the vehicle will encounter.



AMBIENT AIR TEMPERATURE

SERVICE

Recommended lubricant change intervals are dependent on the application and operating environment. The following chart should be used to establish proper change intervals.

APPLICATION	PETROLEUM BASED		SYNTHETIC BASED**	
	MILES	INTERVAL	MILES	INTERVAL
On Highway	100,000	1 Year	250,000	3 Year
* Severe Service and On-Off Highway	50,000	1 Year	100,000	1 Year

**Severe service includes any applications operating at or near maximum GVW or GCW ratings. This includes normally wet or dusty environment, or consistent high load and low speed applications.*

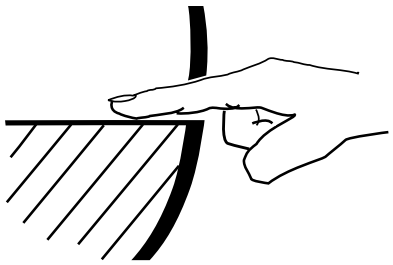
***Includes Semi-Synthetic blends that meet MIL-L-2105D specifications.*

SUBMERSION OR DEEP WATER FORDING

In the event the carrier housing should become submerged in water, particularly if over the vent plug, it is recommended that the lubricant be drained and all internal parts be inspected for water damage and/or contamination. Reassemble the carrier to the housing and refill with specified gear lubricant.

AFTER OVERHAUL OR CHANGE INTERVALS

Fill the axle assembly to the bottom of housing fill hole as shown in the illustration below. It is recommended that following an overhaul, each side of the axle be jacked up seperately to approximately six inches and held into position for one minute. This procedure will allow adequate lubricant to flow into the wheel ends and help eliminate the possibility of premature damage to wheel bearings and seals. Lower the vehicle to the floor and allow ten minutes for lube to return to normal level. Check and refill assembly to bottom of fill hole to replace the lubricant that was directed into the wheel ends.



NOTE: Lubricant close enough to the bottom of the fill hole to be seen or touched is not sufficient. Lubricant must be level with the fill hole.

PATENTED, PRESSURIZED LUBRICATION SYSTEM

The lube system for our two-speed axle line is unique in the industry. It's closed and pressurized so that oil constantly flows to critical components. The tapered roller bearings act as a pump which provides pressurized lube through the internal channels in the carrier to the differential bearings, planetary gears, and differential gears.

⚠ IMPORTANT

READ THIS SECTION BEFORE STARTING ANY SERVICE PROCEDURES

Safety glasses should be worn at all times when assembling or disassembling axles.

SAFETY PRECAUTIONS

Proper service and repair of vehicle components is important to the safe and reliable operation of all motor vehicles. This applies particularly to driving axles such as the ones described in this manual. The procedures recommended and described in this manual are tested, effective methods for performing service operations. Follow each procedure closely, making use of both the text and illustrations. Some of these service procedures show the use of certain tools designed specifically for the operation being performed. They are shown as a preferred means of performing the operation. It is not practical to anticipate and advise the service trade of all possible alternative methods, and of all possible hazardous consequences that could occur.

Accordingly, anyone who uses a service procedure or tool different than shown must insure that their safety, and the vehicle's safety, will not be jeopardized by the service method selected.

REBUILD FACILITIES

A suitable holding fixture or carrier overhaul stand is desireable, but not necessary to rebuild these units. Alternatley, a sturdy shop table of approximately 30 inches in height can be used with suitable means to hold the carrier securely for rebuild operations. A light chain hoist should be used to relocate the carrier housing and to install or remove the ring gear and support case assembly.

END YOKES AND FLANGES

⚠ CAUTION: Hammering on end yokes can close in the bearing bores or misalign yoke lugs and result in early failures of journal needle bearings or other driveline components. Serious damage can also be done internally to the ring and pinion set or pinion bearings by hammering on external parts. End yokes or companion flanges should be removed or installed using the recommended methods outlined in this manual.

CLEANLINESS

Axle components should be steam cleaned prior to removal from the vehicle. Dirt is abrasive and will cause premature wear of otherwise serviceable parts. Service personnel should use a wash tank for thorough cleaning of parts just prior to reassembly.

⚠ CAUTION

BRAKE LININGS CONTAIN NON-ASBESTOS FIBERS

BREATHING BRAKE DUST MAY BE HAZARDOUS TO YOUR HEALTH AND MAY CAUSE SERIOUS RESPIRATORY OR OTHER BODILY HARM.

AVOID CREATING DUST

DO NOT REMOVE BRAKE DRUM WITHOUT PROPER PROTECTIVE EQUIPMENT.

DO NOT WORK ON LININGS WITHOUT PROPER PROTECTIVE EQUIPMENT.

DO NOT REPLACE LININGS WITHOUT PROPER PROTECTIVE EQUIPMENT.

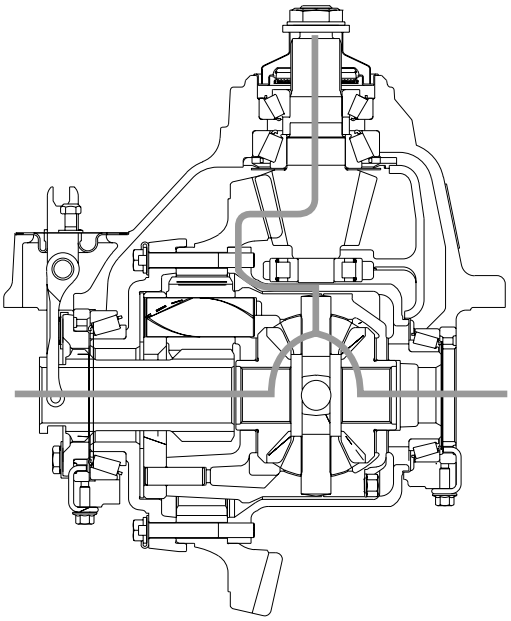
DO NOT ATTEMPT TO SAND, GRIND, CHISEL, FILE, HAMMER OR ALTER BRAKE LININGS IN ANY MANNER WITHOUT PROPER PROTECTIVE EQUIPMENT.

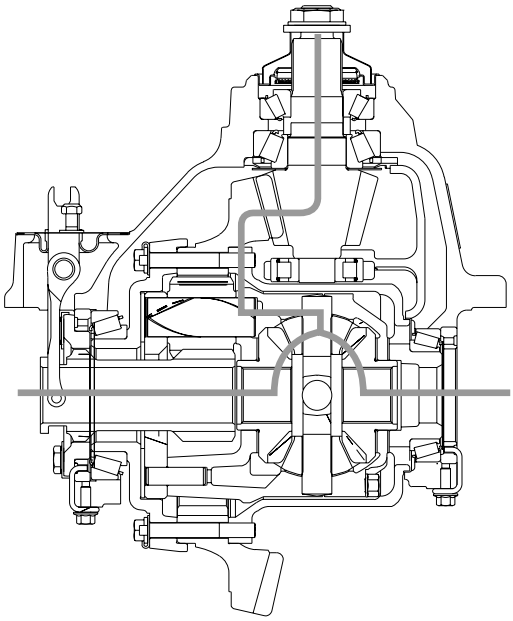
FOLLOW 0.S.H.A. STANDARDS FOR PROPER PROTECTIVE DEVICES TO BE USED WHEN WORKING WITH BRAKE MATERIALS.

TWO SPEED AXLE FEATURES

This Spicer axle assembly consist of a full float, cold formed and welded, banjo-type housing member to which the differential carrier assembly is bolted. The banjo housing is the vehicle load carrying member, and the differential carrier assembly is the torque transmitting portion of the axle. It consist of a primary hypoid gear set for high range operation, and a secondary planetary type spur gear set, which is combined with the primary gear set, for low range operation. Range changes are easily made by means of a hand control button mounted on the gear shift lever (See Two-Speed Operating Instructions, Pg. 25) The control button causes the planetary sun gear to act as a sliding clutch member, and moves it in and out of engagement with two clutching plates to complete range changes.

POWER FLOW DIAGRAMS





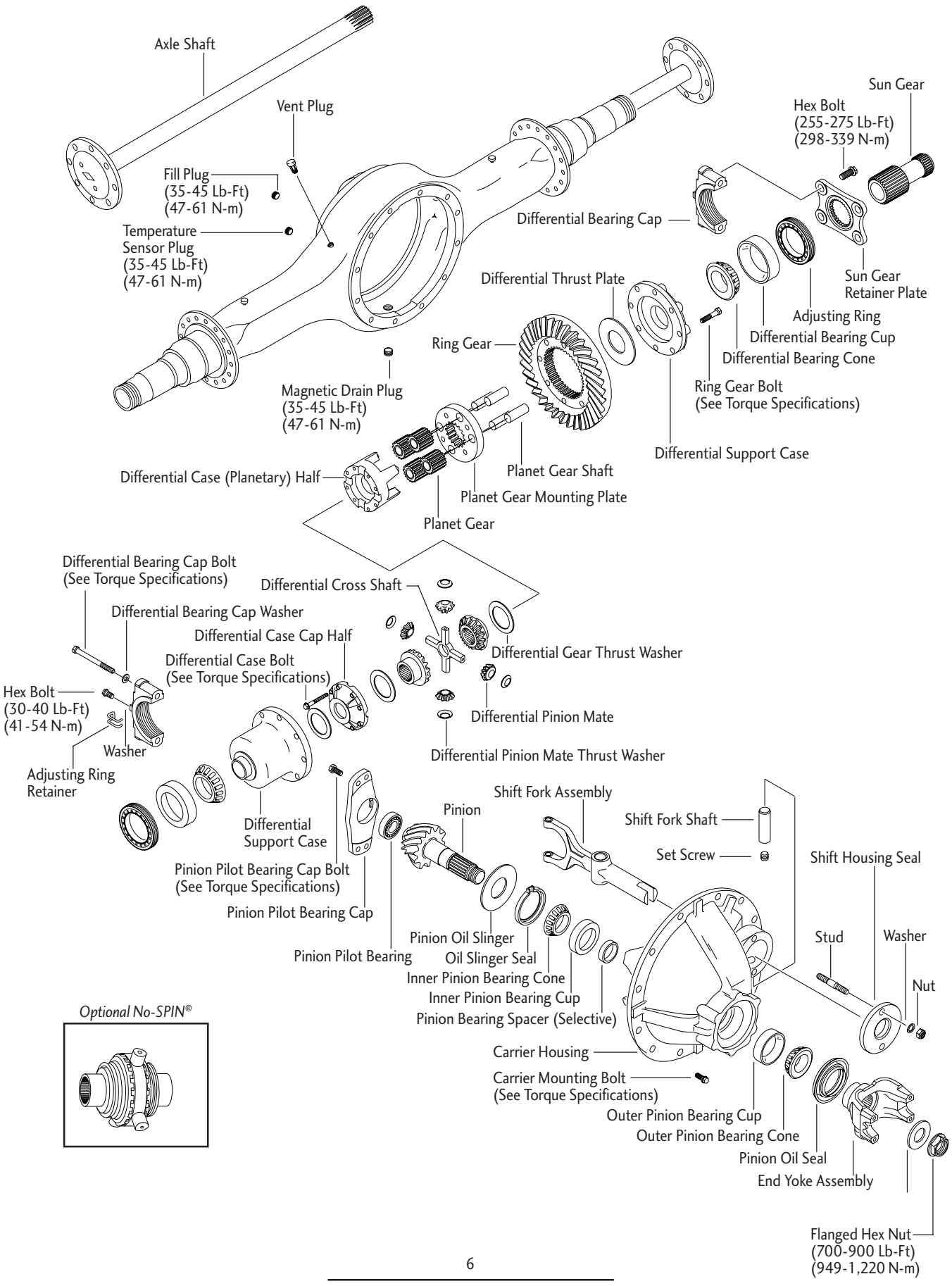
HIGH RANGE

In high range, the sun gear locks the planet gears with the planet plate and the ring gear. The unit then functions as a single reduction axle. Power flows in the pinion to the ring gear through the differential case to the differential cross shaft. The cross shaft transfers it through the differential pinion mates to the left and right differential side gears, and finally to the axle shafts.

LOW RANGE

In low range, engine power is transmitted to the hypoid ring gear as before. It then flows to the ring gear internal spur teeth, which transfers it to the planet gears that are attached to the differential case. Because the sun gear is clutched to a stationary retainer plate, it cannot rotate and acts as a reaction member for the planet gears. This causes the planet gears to rotate around the sun gear, driving the differential case at a speed slower that the ring gear, creating the additional low range reduction ratio and further multiplying engine torque. From this point, power flows in the same sequence as when the axle is in high range.

AXLE COMPONENTS



REMOVAL OF DIFFERENTIAL CARRIER FROM AXLE HOUSING

1. Shift the axle into low range. (See Two Speed Operating Instructions, Pg. 25)
2. Remove the drain plug and drain lubricant.
3. Remove the shift unit from carrier assembly.

NOTE: Shift unit contains lube. Provide container to catch lubricant.

NOTE: For servicing the shift unit, refer to Vehicle Service Manual.

4. Disconnect drive shaft at rear u-joint.

NOTE: If ring or pinion bearings are to be removed, break loose pinion nut at this time.

5. Remove axle shaft cap screws and lock washers, or stud nuts and cone locks. Remove axle shafts. If gasket is assembled between the hub and shaft, discard the old gasket and replace with a new one at time of reassembly.

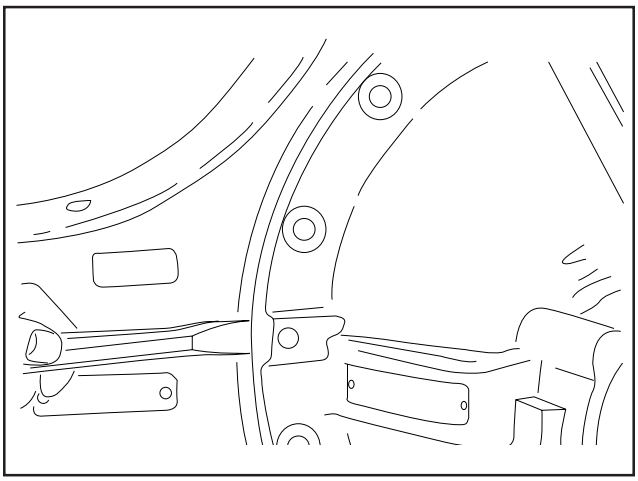
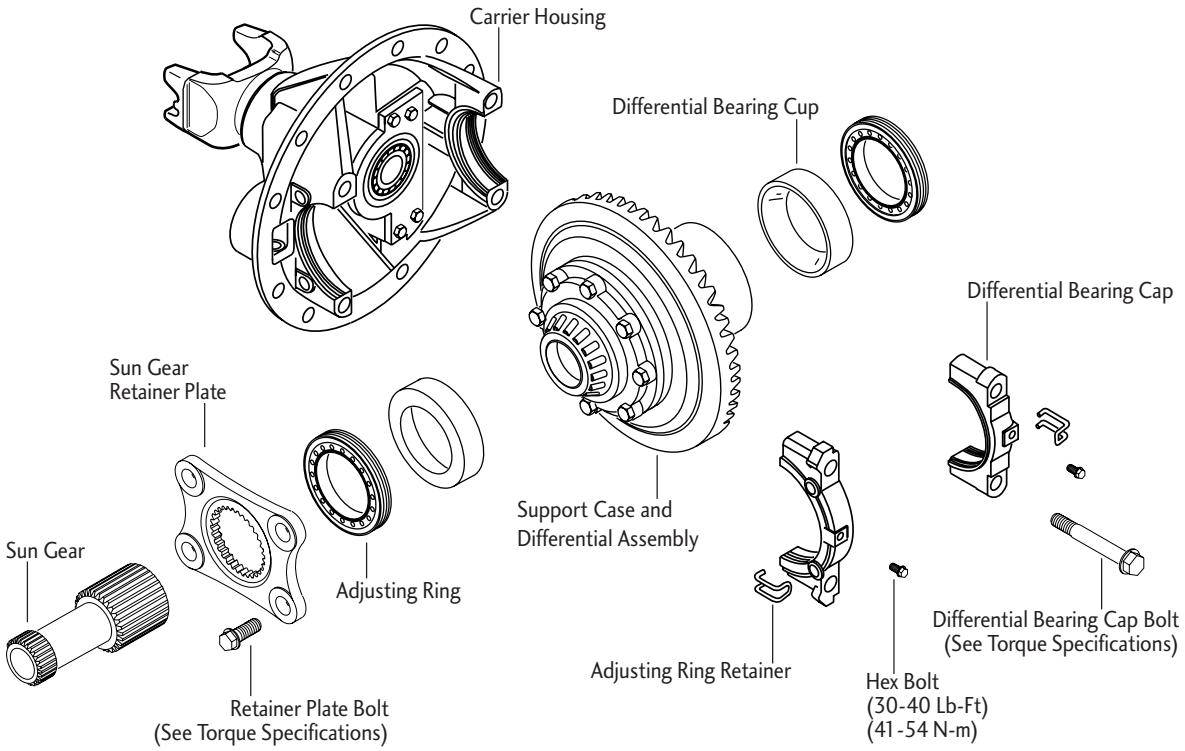


Figure 1

6. Support the carrier on a roller jack.
7. Remove the carrier-to-housing bolts.
8. Break carrier loose from housing with use of pry bars behind carrier flange mounting face. See Figure 1.

Removal of Carrier from Axle Housing Complete

DISASSEMBLY OF DIFFERENTIAL CARRIERS



1. Place the carrier in a suitable holding fixture such as a carrier repair stand. If ring gear and pinion are to be reused, measure gear backlash prior to disassembly.
2. For double reduction models, remove the two bolts and the double reduction plate. (Proceed to step 7)
3. For two speed models, remove the shift fork spring and seal from the carrier housing.

4A. New Style:

Remove set screw and shift fork shaft. Remove shift fork. (Proceed to step 7)

4B. Old Style:

Remove the shift fork shaft snap ring, using suitable snap ring pliers. Be sure to retrieve the retaining ring so that it will not be lost in the differential carrier.

5. Remove sealer from shift fork shaft holes.
6. Remove shift fork shaft by using a drift and hammer.

NOTE: Shaft will only drive out in one direction.

7. Remove sun gear.
8. Remove four sun gear retainer bolts and sun gear retainer plate.

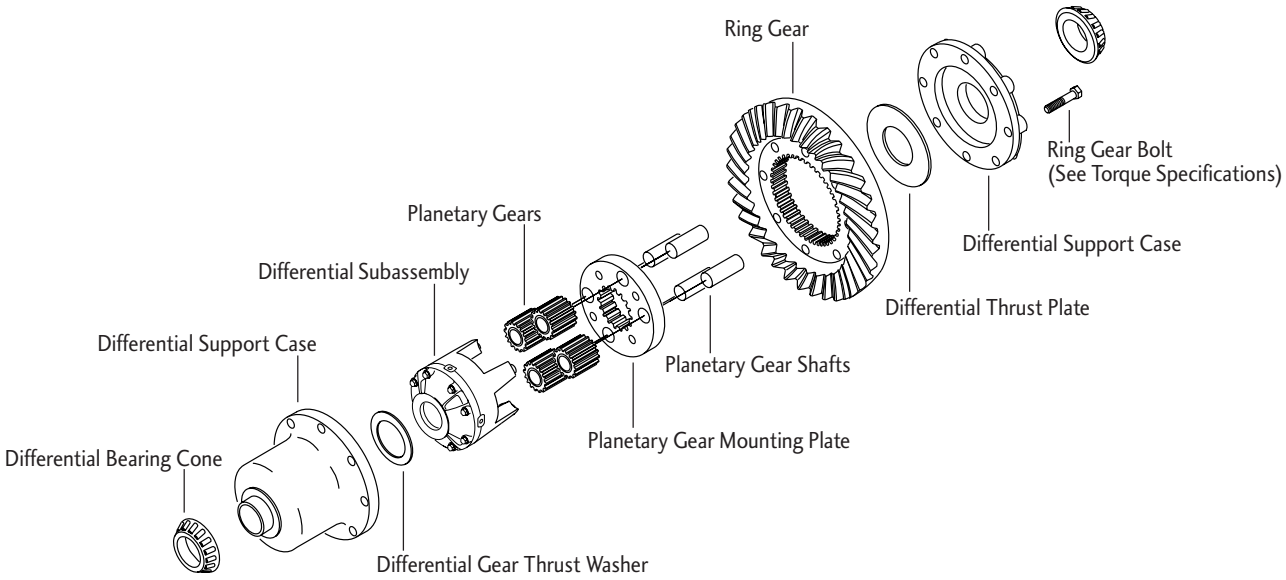
NOTE: For ease of disassembly, the ring gear bolts can be loosened at this time.

9. Remove adjusting ring retainers.
10. Remove four differential bearing cap bolts.
11. Back out either adjusting ring to relieve preload.
12. Remove bearing caps.
13. Remove adjusting rings.
14. Lift the ring gear and differential sub-assembly out of carrier. The ring gear side of the subassembly must be tipped up for the ring gear to clear the pinion roller bearing retainer.

NOTE: Use care to avoid damage to the ring gear and pinion.

Differential Disassembly Complete

RING GEAR AND SUPPORT CASE DISASSEMBLY



1. Prior to disassembly, match mark support case halves for reassembly in the same position. See Figure 2.

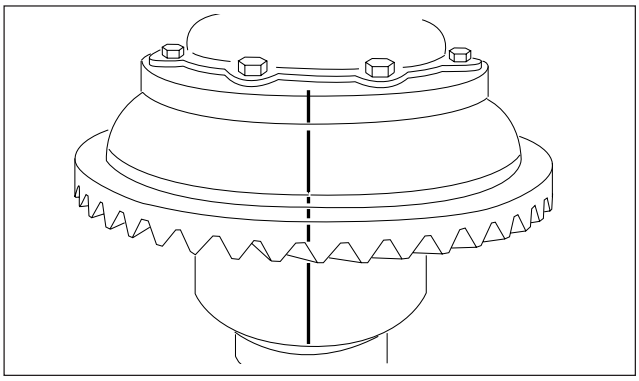


Figure 2

2. Remove ring gear bolts. Remove differential support case from ring gear using pry bars.

NOTE: It is recommended that whenever the ring gear bolts are removed, they be replaced with a new set.

3. Remove aluminum differential thrust plate.

NOTE: Thrust plate may be retained in support case, due to oil rentention. It should be removed and cleaned before reassembly.

4. Remove planetary gear mounting plate. Use *care* to avoid damage to surfaces of plate and planetary gear shafts.

5. Remove planetary gears and planetary gear shafts.

6. Turn assembly over and support on differential subassmbly dowel pins.

CAUTION: Care must be taken to keep differential subassembly properly positioned in support case to prevent damage when removing ring gear.

7. Rotate ring gear to make sure support case is seated squarely on differential subassembly. Using a soft hammer, tap each side of ring gear alternatley to remove from support case half.

8. Lift support case form differential subassembly. Remove thrust washer from differential subassembly.

9. If either the left or right differential support case bearings are to be replaced, remove them using a suitable puller. See Figure 3.

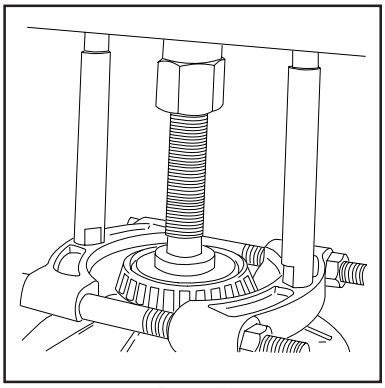
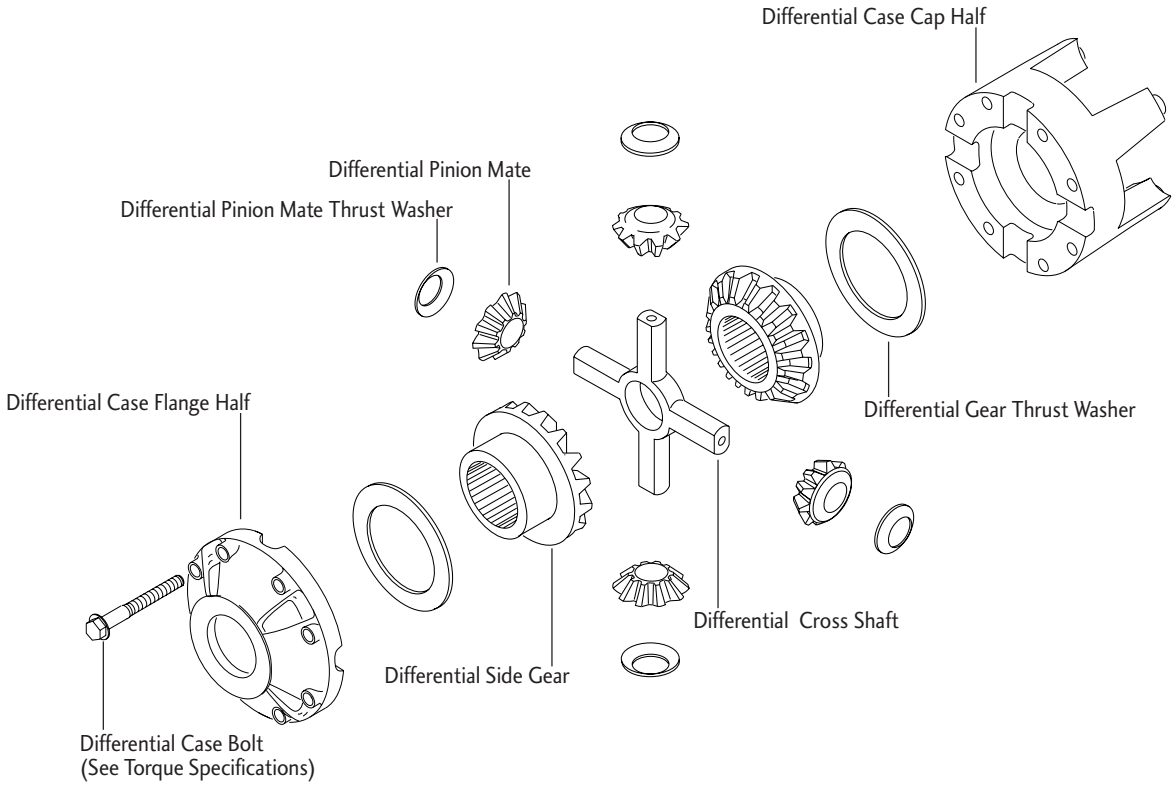


Figure 3

Ring Gear and Support Case Disassembly Complete

DIFFERENTIAL DISASSEMBLY



NOTE: Differential case halves are matched and marked during the manufacturing process. No further marking necessary. See Figure 4.

1. Remove differential case bolts and lift off right hand case half.
2. Remove thrust washer and differential side gear.
3. Lift out cross shaft, differential pinions, and thrust washers.

NOTE: Inspect all parts, inlcuding the matched surfaces of the case itself. Where necessary, replace all worn parts. If excessive wear is noticed on all parts, it is suggested that the complete differential assembly be replaced.

If any gears are to be replaced, they must be replaced in sets. Inspect thrust washers for scoring and excessive wear; replace if necessary.

4. Lift out differential side gear and thrust washer.

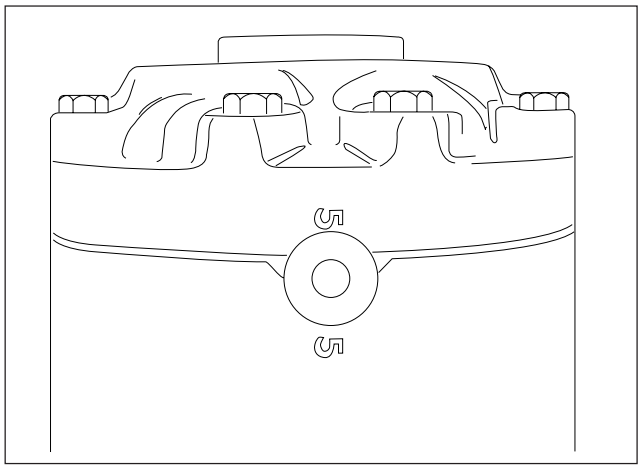
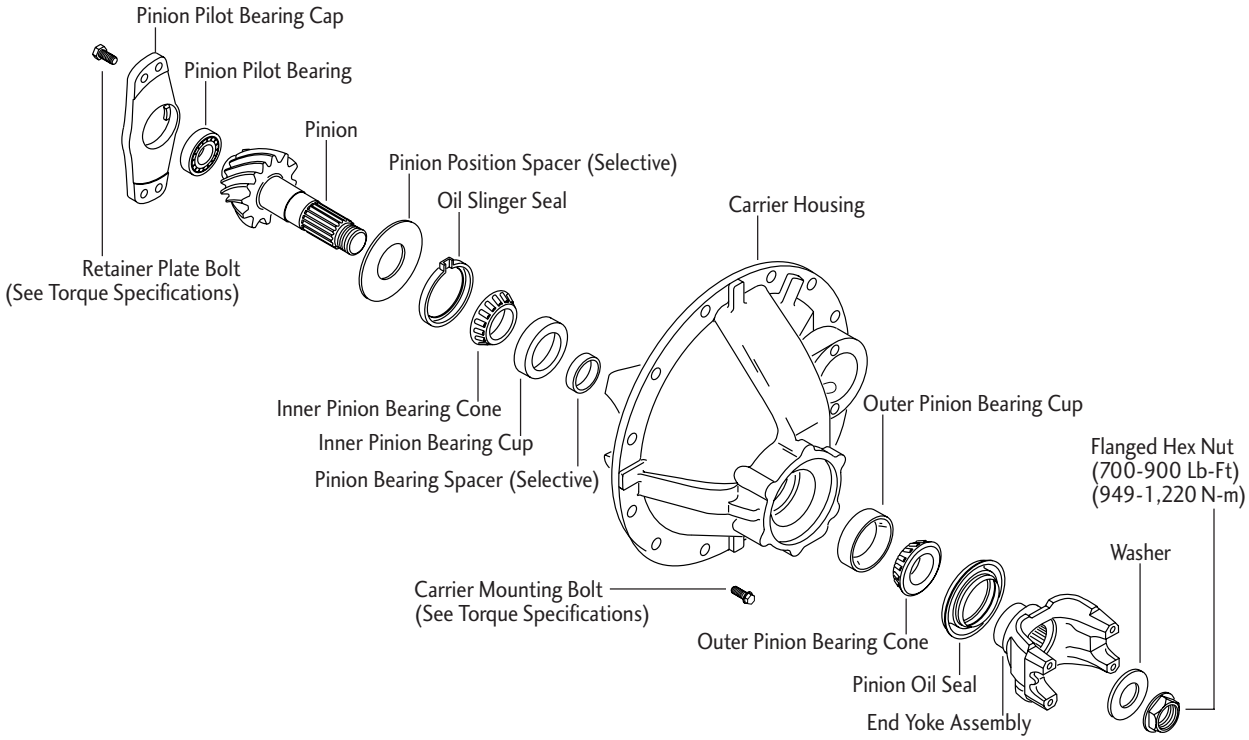


Figure 4

Differential Disassembly Complete

PINION DISASSEMBLY



1. Turn the carrier to a vertical position and remove the four pilot bearing cap bolts. Lift the pilot bearing cap from the roller bearing and carrier housing, tapping with soft hammer from underneath side if necessary.
2. Turn the nose of the carrier to a horizontal position to remove the flanged hex nut. Hold the end yoke stationary, and remove the flanged hex nut and washer.

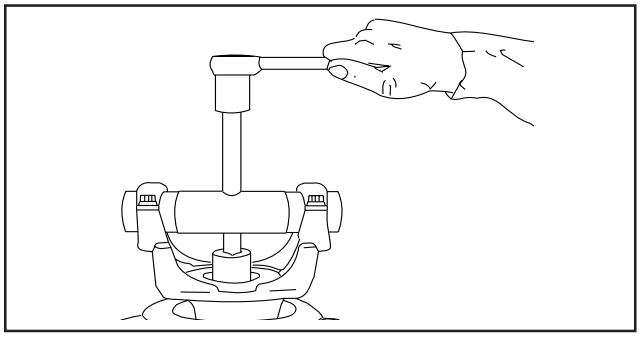


Figure 5

3. Remove the end yoke using a suitable puller. See Figure 5.
4. Replace flanged hex nut (finger tight). Tap pinion free of bearing with soft hammer.
5. Supporting pinion from inside carrier, remove flanged hex nut.
6. Remove pinion.
7. Near the spline end of the pinion and between the pinion bearings is a (selective) pinion bearing spacer used for pinion bearing preload. Retain this spacer for possible use in reassembly.
8. Remove pinion pilot bearing from end of pinion.
9. Remove inner bearing cone from pinion.
10. Remove the pinion oil seal. Discard the seal and replace it with a new one at time reassembly. Remove the outer pinion bearing cone.
11. Rotate carrier to pinion nose down position. Remove the pinion oil slinger seal from the carrier and discard. Install a new seal at the time of reassembly.
12. With nose of the carrier down, remove the outer pinion bearing cup.
13. Turn the carrier over and remove the inner bearing cup.

CAUTION: Do not nick the carrier bearing bore.

Pinion Disassembly Complete

CLEANING AND INSPECTION

CLEANING

1. Parts should be cleaned with emulsion cleaners or petroleum base cleaning solvent.

NOTE: Alkaline type solutions may cause damage to machined surfaces and should be avoided.

2. Make sure interior of axle housing is clean prior to reassembly.

3. Clean all gasket surfaces of old material.

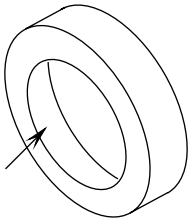
DRYING

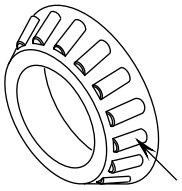
Use soft, clean, lintless towels or rags to dry components after cleaning. Bearings should *not* be dried by spinning with compressed air. This can damage mating surfaces due to the lack of lubrication.

After drying, parts should be coated with a light coat of lubricant or rust inhibitor to prevent damage from corrosion. If parts are to be stored for a prolonged period, they should be wrapped in wax paper.

INSPECTION

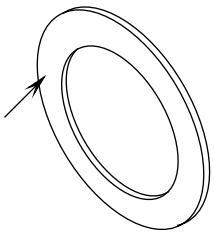
Prior to reassembly, inspect parts for signs of excessive wear or damage. Replacement of these parts can prevent premature failure and costly downtime.

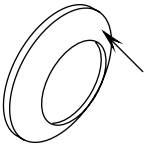




BEARINGS

Bearing surfaces should be inspected for pitting, excessive wear, or overheating.

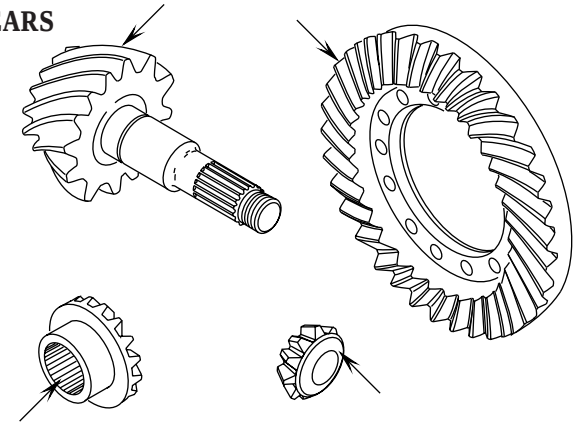




THRUST WASHERS

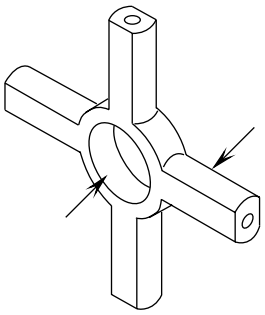
Inspect thrust washers for scoring and cracking.

GEARS



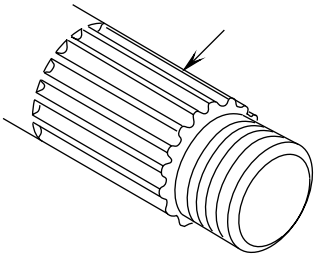
Inspect gears for excessive wear or damage. Replace gears that are pitted, scored, broken, or worn.

SHAFTS



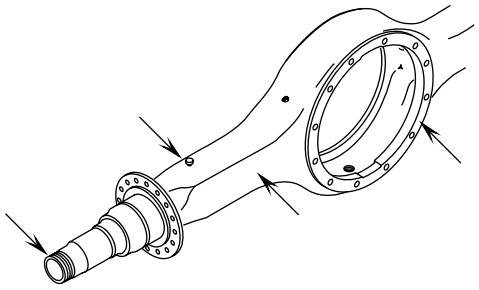
Inspect shafts for nicks or scoring.

SPLINES



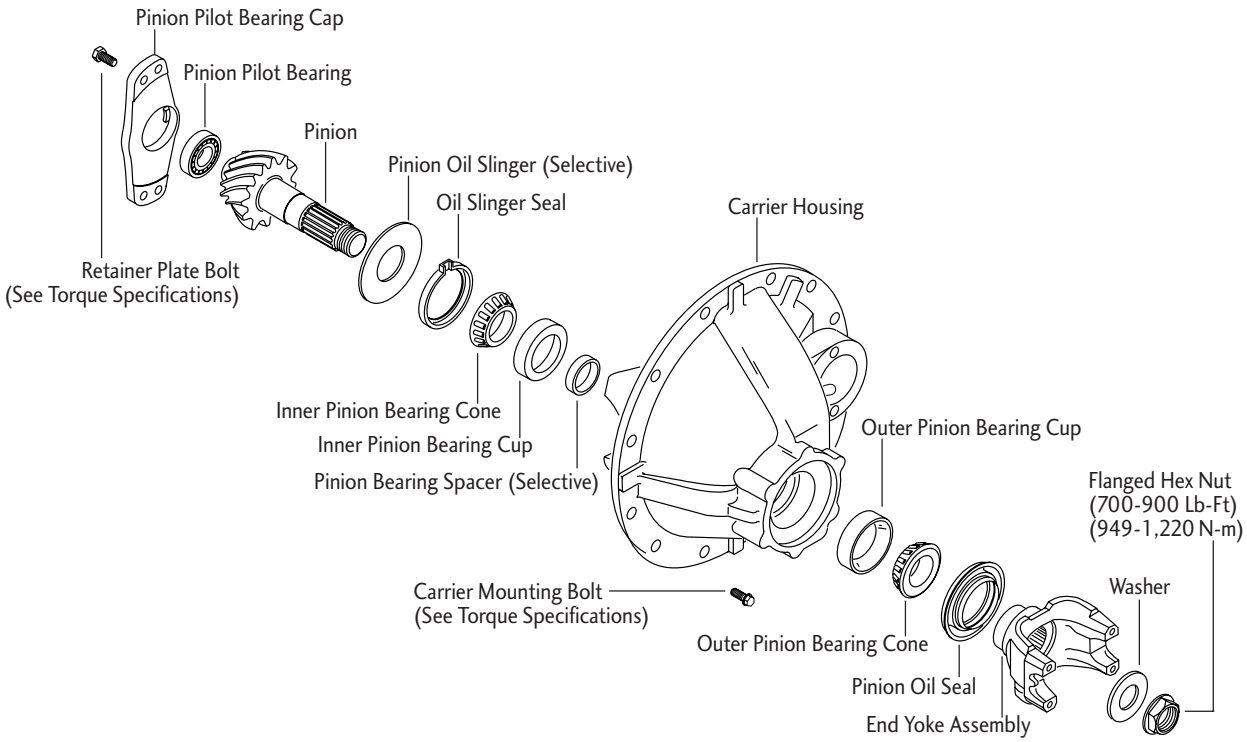
Inspect all splines for excessive wear, distortion from twisting, and cracking.

HOUSINGS

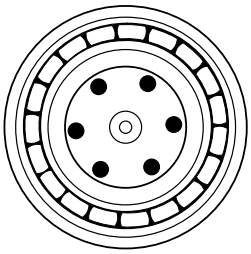


Inspect housing for stripped threads and bending fatigue.

PINION ASSEMBLY



1. Assemble the proper pinion position spacer, oil slinger seal and inner bearing cone onto the pinion.
2. Press pinion pilot bearing on the pinion.
3. Stake pinion pilot bearing onto pinion in six places, using a center punch or equivalent tool. See illustration on right.



NOTE: Make sure all carrier bores are free from all nicks, dirt, or any other contamination.

4. Install the inner and outer bearing cups into the carrier.
5. Use a feeler gauge or shim stock to ensure bearing cups are completly seated in bearing bores (.0015" approx.). This is necessary for proper pinion position. See Figure 8.
6. Install inner pinion oil slinger seal into the carrier with the tabs locking into the oil channel. Make sure the flat side of the seal is seated against the bottom of the bearing cup bore so that the lip side will be against the pinion oil slinger.
7. Install pinion into carrier using slow steady movement when sliding through inner bearing cup and seal. The pinion should be restrained from end movement by using a retaining strap. See Figure 9.

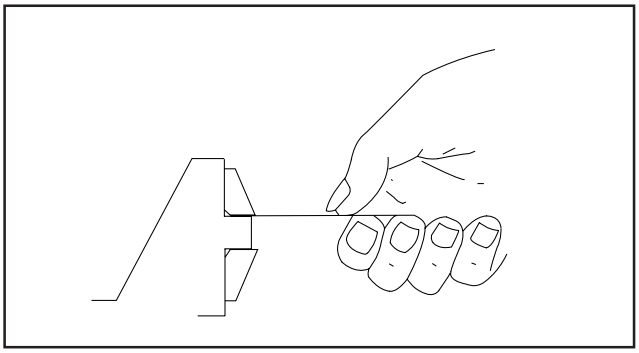


Figure 8

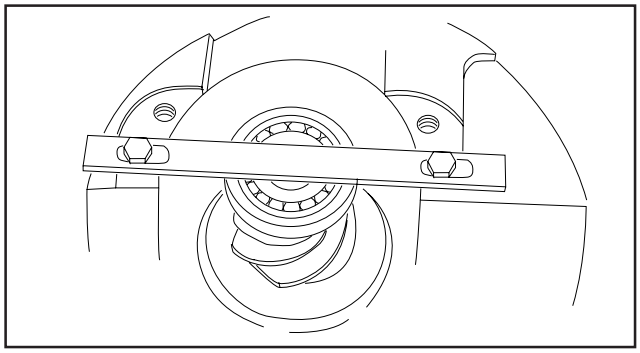


Figure 9

PINION ASSEMBLY

8. Rotate carrier to a vertical position. Place pinion bearing spacer (selective) on pinion. Install outer bearing cone onto pinion.

NOTE: The reason for not assembling a new pinion oil seal at this time is due to the possibility of having to adjust pinion preload or pinion position. It would be necessary to again remove the seal and, as mentioned, whenever seals are removed, they are to be discarded because of possible damage.

9. Inspect end yoke seal surface for grooves caused by seal lip. If grooves can be detected with a fingernail, yoke should be replaced or have repair sleeve installed.

10. Assemble end yoke, washer and old flanged hex nut onto pinion. Torque nut to 700-900 Lb-Ft (949-1,220 N-m). The old nut can be used during this adjustment phase of the assembly, saving the new one for final assembly.

11. Remove pinion retainer strap. Using an in-lb torque wrench rotate pinion noting rolling torque. Rolling torque of pinion should read between 20-50 in-lb (2.3-5.7 N-m).

    To increase preload, decrease thickness of preload spacer: to decrease preload, increase thickness of preload spacer. Every .001" (.025 mm) change in thickness of preload spacer changes torque to rotate by approximately 30 in-lb.

NOTE: A pinion bearing spacer (selective) is used to develop pinion bearing preload. See list in next column for available thicknesses. Measure the spacer with a micrometer before assembly to insure correct thickness.

12. Remove flanged hex nut, washer and end yoke. Apply a light coat of lubricant to the lip of the seal and assemble into housing.

13. Assemble end yoke, washer, and new flanged hex nut. Torque to 700-900 Lb-Ft (949-1,220 N-m). Recheck torque to rotate.

Pinion bearing spacers (selective) are available in the following thicknesses.

Inches	MM	Inches	MM
.700	17.780	.714	18.136
.701	17.805	.715	18.161
.702	17.831	.716	18.186
.703	17.856	.717	18.212
.704	17.882	.718	18.237
.705	18.907	.719	18.263
.706	18.932	.720	18.288
.707	18.958	.721	18.313
.708	18.983	.722	18.339
.709	18.009	.723	18.364
.710	18.034	.724	18.390
.711	18.059	.725	18.415
.712	18.085	.726	18.440
.713	18.110	.727	18.466

NOTE: Inspect pinion pilot bearing cap for proper spotface and chamfer at the four bolt holes as shown in Figure 10. If spotface and chamfer are not present, machine as required .030 chamfer X 45° for holes and 1.25" spotface X .030 deep at four places.

14. Rotate carrier to vertical position with yoke down. Install pinion pilot bearing cap using soft hammer if necessary.

15. Install four retainer bolts. Torque to:

    G Model 70-80 Lb-Ft (95-108 N-m)
    M Model 110-125 Lb-Ft (149-169 N-m)

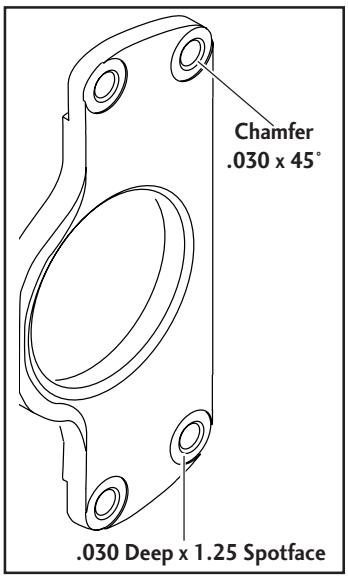


Figure 10

Pinion Assembly Complete

PINION POSITION

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification. If a new gear set is being used, verify the number of each pinion and ring gear before proceeding with assembly. See Gear Set Identification, Pg. 2.

Beginning with carriers GGA-1007032 and MJA-1007160, a new method of setting pinion position has been adopted. A number is etched on the machined surface under the roller bearing retainer plate on each carrier. This number is used in conjunction with the number etched on each pinion to determine the proper pinion bearing spacer (selective) for proper assembly. *It eliminates the need for measuring with special gauge tools.* See Figure 7.

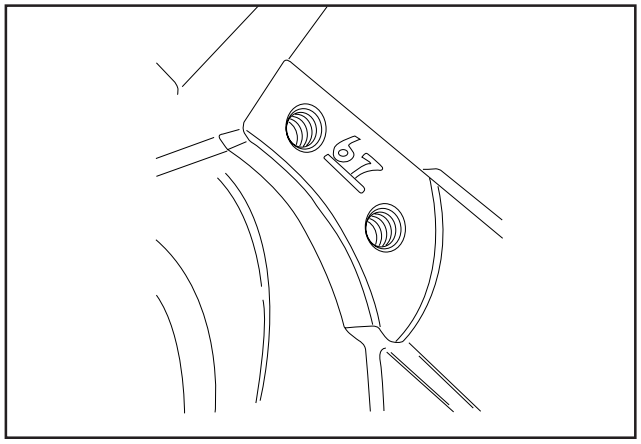
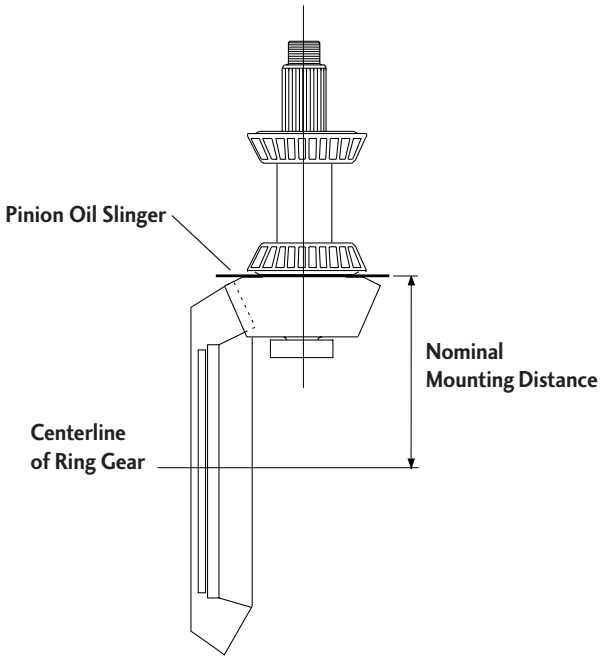


Figure 7

Pinion position is based on the mounting distance measured from the centerline of the ring gear to the back of the pinion head (See Illustration, top of next column). This dimension is controlled by shimming between the oil slinger seal and pinion head with a pinion position spacer (selective).

On the nose of each pinion either a plus (+), minus (-), or a zero (0) will be etched. See Gear Set Identification, Pg. 2. This number represents the amount in thousandths of an inch (.001) to be added or subtracted from the nominal mounting dimension for the best running position for that particular gear set.



A plus (+) number etched on the pinion would mean that number must be added to the nominal mounting distance to get the required mounting distance.

EXAMPLE:

If pinion is etched +3, the required mounting distance is more than nominal by .003 in. (.076 mm). This means the pinion would require .003 in. (.076 mm) *thinner* shim between pinion and oil slinger seal than a pinion etched with "0" to allow for this difference. To achieve proper pinion position, decrease the pinion position spacer thickness by .003 in. (.076 mm).

Similarily, if the pinion is marked -3, the shim required between pinion and oil slinger seal would be .003 in (.076 mm) *thicker* than if pinion was etched "0" to allow for this distance. To acheive proper pinion position, increase the pinion position spacer thickness by .003 in. (.076 mm).

The number etched on the carrier also refers to the mounting distance, based on a "0" etched pinion. This number represents thicness in thousandths of the pinion position spacer (selective) required for a "0" etched pinion.

PINION POSITION

The following examples illustrate how the carrier etch and the pinion etch interact:

	EXAMPLE "A"	EXAMPLE "B"
Number etched on nose of pinion	**+3**	**-2**
Number etched on carrier	**63**	**61**
Add or subtract pinion etch from carrier etch to get correct pinon postion spacer.	**.063** **-.003**	**.061** **+.002**
	.060	**.063**

Select a pinion postion spacer that is closest to the calculated value from table.

NOTE: The pinion position spacer functions as a selective shim to determine the position of the pinion mounting distance.

Pinion position spacers (selective) are available in the following thicknesses.

Inches	MM
.052	1.321
.055	1.397
.058	1.473
.061	1.549
.064	1.626
.067	1.702
.070	1.778
.073	1.854
.076	1.930
.079	2.007
.082	2.083

NOTE: Measure the new pinion position spacer with a micrometer before assembly to insure correct thickness. Be sure mounting surfaces and shims are free of dirt and nicks prior to assembly or leaks will occur and pinion position can be affected.

PINION SETTING

When a new gear set is being installed, use a micrometer to measure the thickness of the old pinion position shims. Measure each shim separately and add together to get the total thickness of the original build-up.

NOTE: If old shims are bent or mutilated they should be replaced.

If a new gear set is being used, notice the (+), (–) or "0" etching on both the old and the new pinions, and adjust the thickness of the shims to compensate for the difference of these two figures (as shown in table on next page).

For example, if the old pinion is etched +2, and the new pinion is –2, subtract .004 in. from the thickness of the original shims used to position the pinion.

If either or both the pinions are etched beyond the values on this chart, follow the same procedure to establish correct pinion position.

For example if the old pinion is etched –12 and the new pinion is etched +9, add .021 inch to the thickness of the original shims.

After determining the new total build up of pinion position shims, round the figure off to the nearest multiple of .005 inch.

Use the Pinion Setting Chart on the next page as a guideline to set the pinion.

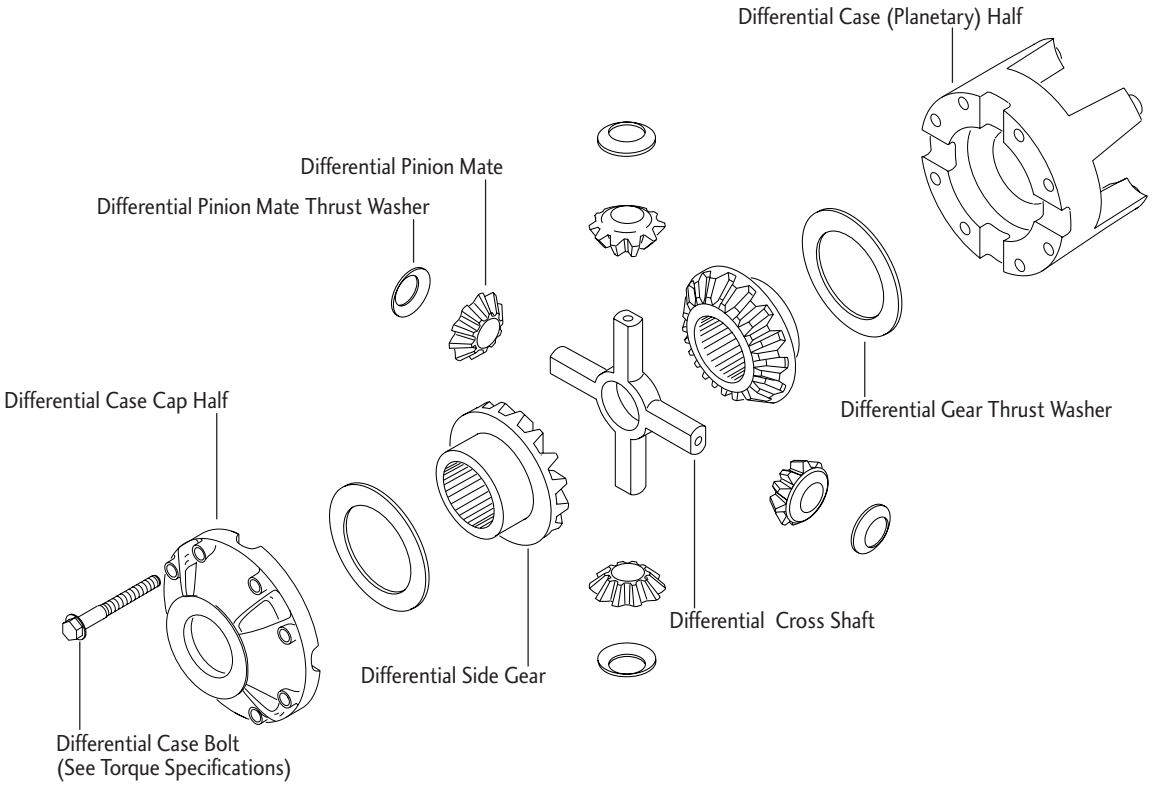
G AND M PINION SETTING CHART(OLD TO NEW PINION)

0.000 TOP(INCHES)
.000 BOTTOM(MM)

NEW PINION MARKING

OLD PINION MARKING	-10 M-25	-9 M-23	-8 M-20	-7 M-18	-6 M-15	-5 M-13	-4 M-10	-3 M-08	-2 M-05	-1 M-03	0	+1 M+03	+2 M+05	+3 M+08	+4 M+10	+5 M+13	+6 M+15	+7 M+18	+8 M+20	+9 M+23	+10 M+25
+10 M+25	+0.020 .508	+0.019 .483	+0.018 .457	+0.017 .432	+0.016 .406	+0.015 .381	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0
+9 M+23	+0.019 .483	+0.018 .457	+0.017 .432	+0.016 .406	+0.015 .381	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025
+8 M+20	+0.018 .457	+0.017 .432	+0.016 .406	+0.015 .381	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051
+7 M+18	+0.017 .432	+0.016 .406	+0.015 .381	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076
+6 M+15	+0.016 .406	+0.015 .381	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102
+5 M+13	+0.015 .381	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127
+4 M+10	+0.014 .356	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152
+3 M+08	+0.013 .330	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178
+2 M+05	+0.012 .305	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203
+1 M+03	+0.011 .279	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227
0	+0.010 .254	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254
-1 M-03	+0.009 .227	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279
-2 M-05	+0.008 .203	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305
-3 M-08	+0.007 .178	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330
-4 M-10	+0.006 .152	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356
-5 M-13	+0.005 .127	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356	-0.015 .381
-6 M-15	+0.004 .102	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356	-0.015 .381	-0.016 .406
-7 M-18	+0.003 .076	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356	-0.015 .381	-0.016 .406	-0.017 .432
-8 M-20	+0.002 .051	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356	-0.015 .381	-0.016 .406	-0.017 .432	-0.018 .457
-9 M-23	+0.001 .025	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356	-0.015 .381	-0.016 .406	-0.017 .432	-0.018 .457	-0.019 .483
-10 M-25	0	-0.001 .025	-0.002 .051	-0.003 .076	-0.004 .102	-0.005 .127	-0.006 .152	-0.007 .178	-0.008 .203	-0.009 .227	-0.010 .254	-0.011 .279	-0.012 .305	-0.013 .330	-0.014 .356	-0.015 .381	-0.016 .406	-0.017 .432	-0.018 .457	-0.019 .483	-0.020 .508

DIFFERENTIAL ASSEMBLY



1. Apply a small amount of lubricant to all mating surfaces. This will keep the thrust washers in place during assembly, and provide for initial lubrication.
2. Place thrust washer and differential side gear in differential case (planetary) half.
3. Assemble differential components and place into differential case (planetary) half.
4. Place side gear and thrust washer in position on differential pinion mates.
5. Position differential case cap half onto above assembly, making sure match marks line up. See Figure 6.

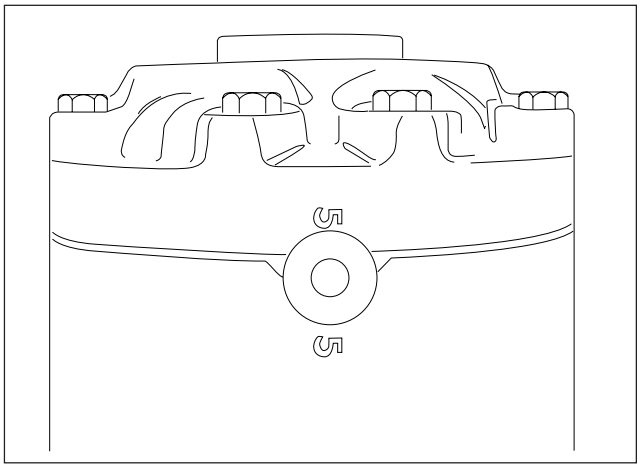


Figure 6

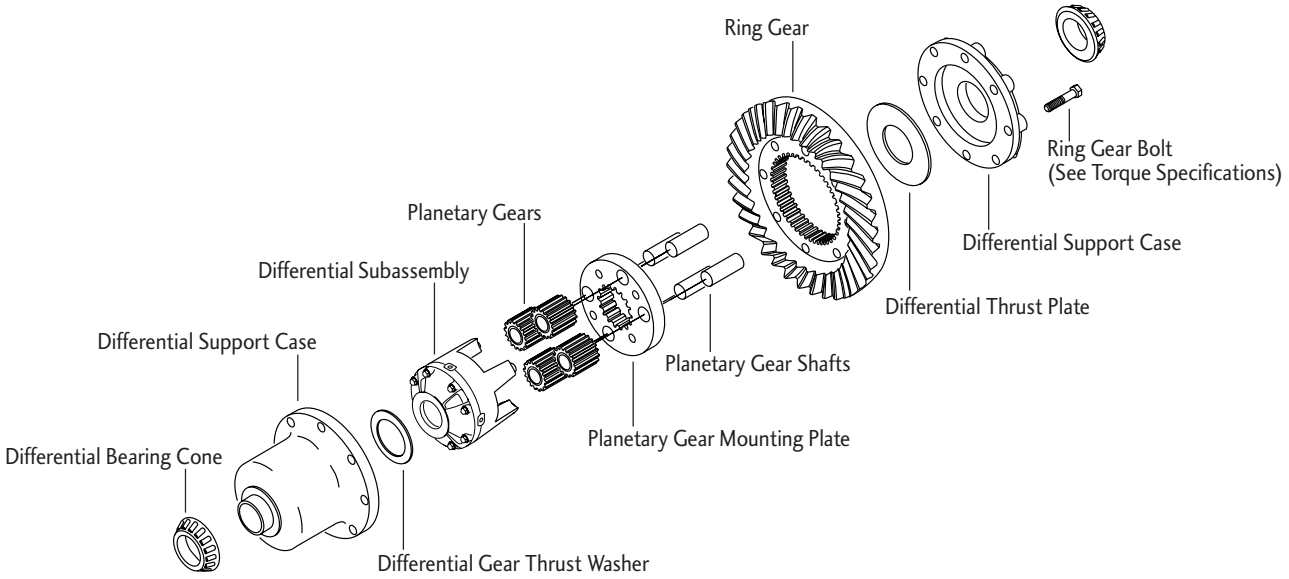
4. Install differential case bolts (M230-T export model has 12 bolts). Tighten alternately and evenly. Torque bolts to:

   G Model: 70-80 Lb-Ft (95-108 N-m)

   M Model: 110-125 Lb-Ft (149-169 N-m)

Differential Assembly Complete

RING GEAR AND SUPPORT CASE ASSEMBLY



1. Install differential bearing cones onto hub of support cases.

NOTE: To protect bearings during the following steps. install bearing cups on bearing cones.

2. Apply lubricant to thrust washer surface and install in differential support case.
3. Install differential assembly into differential support case. Rotate differential assembly to assure proper installation.
4. Install ring gear on differential support case, aligning bolt holes. Make sure ring gear is seated.

NOTE: If old ring gear is used, make sure match marks are aligned.

5. Lubricate and install the four planetary gear shafts in the holes of the differential subassembly. Place the planetary gears in position on the planetary gear shafts.

NOTE: Remove any burrs from planet gear mounting plate.

6. Position the planetary gear mounting plate on the planetary gear shafts and dowels, *with the chamfered teeth facing the planet gears*. Tap the plate with a soft hammer, if necessary, to seat the plate against the differential subassembly.

NOTE: Be sure that the planetary gear shafts and dowel pins are flush to below flush prior to installing thrust plate.

7. Apply lubricant to each side of the differential thrust plate and position the thrust plate on the planetary gear mounting plate.
8. Place the support case on the ring gear and line up the bolt holes. If old ring gear is used make sure match marks are aligned.

NOTE: See Pg. 26 for M230-T export model assembly instructions of ring gear bolts and retainers.

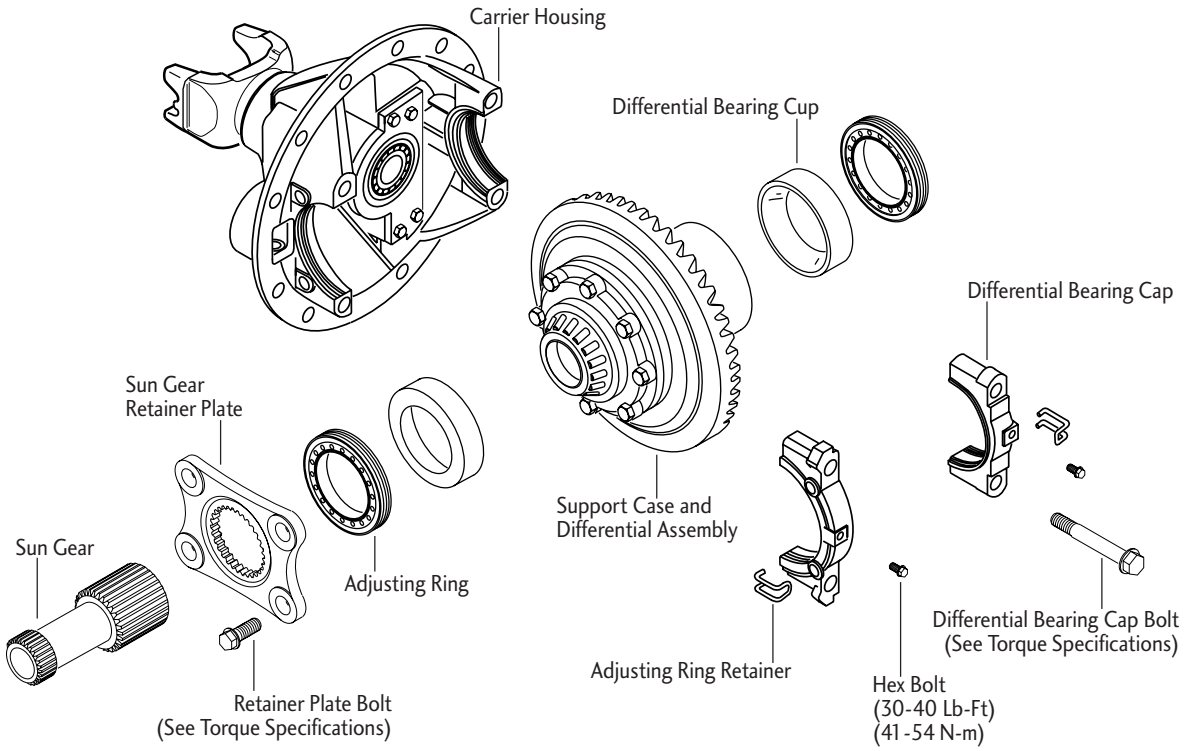
9. Install and tighten the ring gear bolts alternately and evenly. Torque bolts to:

   G Model 110-125 Lb-Ft (149-169 N-m)

   M Model 160-180 Lb-Ft (217-244 N-m)

Ring Gear and Support Case Assembly Complete

DIFFERENTIAL SUPPORT CASE INSTALLATION



1. Install ring gear support case assembly into carrier housing. The ring gear side of the support case must be tipped to clear the pinion roller bearing retainer plate. Care should be taken to avoid damage of ring and pinion gear teeth and bearings. Place bearing cups into position
2. Assemble differential bearing caps. Install bearing cap bolts (finger tight only). Install adjusting rings.
3. Tighten adjusting ring on back side of ring gear until there is zero (0) backlash between the ring gear and pinion.
4. Next, tighten adjusting ring (on the tooth side of ring gear) until cup is seated. Continue to tighten adjusting ring until backlash has returned to measurement taken prior to disassembly.
5. Check ring gear and pinion backlash in four equally spaced positions around the ring gear with a dial indicator.

NOTE: If backlash does not vary more than .003 in. and the average backlash is between .008-.016 in. or (.20-.40 mm) the setting is acceptable.

6. Once proper backlash is established, torque bearing cap bolts to:

   G Model 220-250 Lb-Ft (298-339 N-m)

   M Model 290-350 Lb-Ft (393-475 N-m)

7. Install adjusting ring retainers, washers, and bolts. Torque retainer bolts to 30-40 Lb-Ft (41-54 N-m).

NOTE: Assemble adjusting rings so that the side with two shoulders is facing out to ensure clearance for the bearing (Inside face has only one shoulder). See Figure 11.

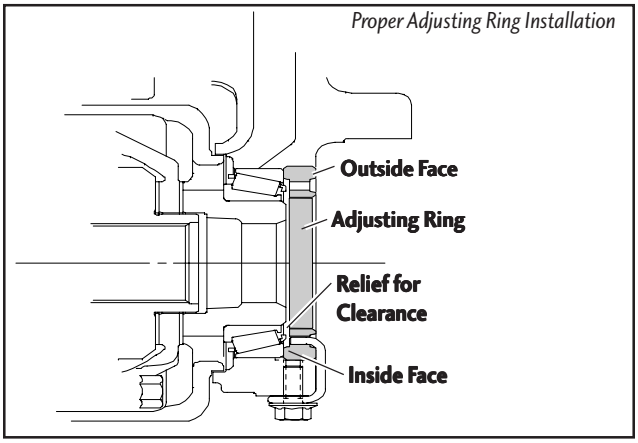


Figure 11

Ring Gear and Support Case Assembly Complete

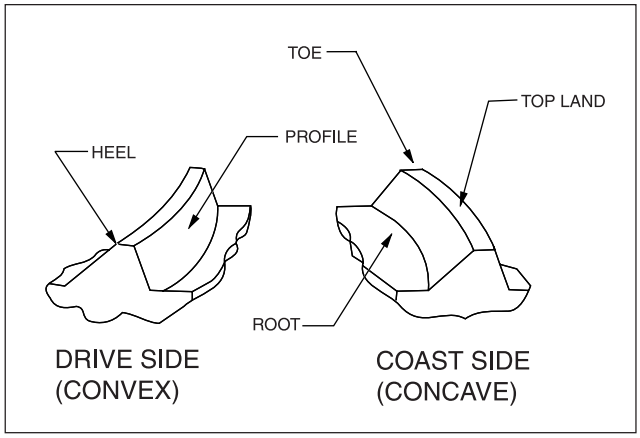
RING GEAR AND PINION TOOTH CONTACT PATTERN

The procedures to the right are to be used to establish proper gear tooth pattern after assembly of the carrier is complete.

NOTE: If matched sets are being reused, measure and record backlash before disassembly, and reassemble to the same backlash. This will match ring and pinion gears to the established wear patterns. Hand rolled patterns will cover less area than the gear pattern established by previous service.

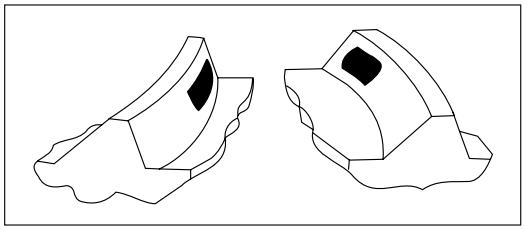
STEP 1. Paint 1/4 ring gear with marking compound on both the drive and coast side.

STEP 2. Rotate ring gear at least one complete revolution in both directions while load is being applied.

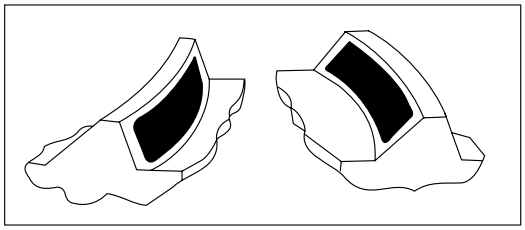


CORRECT GEAR PATTERNS FOR GLEASON CUT GEARS

LIGHTLY LOADED



HEAVILY LOADED



NOTE: Tooth contact pattern, on this axle model, can be moved only by adjusting backlash. The contact pattern can be moved in the direction of heel-to-toe, and toe-to-heel; Depth of the pattern cannot be adjusted. If an acceptable tooth contact pattern cannot be established within limits of backlash, contact Spicer Service at 1-800-666-8688.

SUN GEAR RETAINER INSTALLATION

NOTE: See M230-T export model assembly instructions of Sun Gear Retainer, Pg. 27.

1. Install sun gear retainer plate *with chamfered teeth facing out* and four bolts. For double reduction models: Install the two bottom bolts only. Torque bolts to 220-250 Lb-Ft (298-339 N-m).

NOTE: If lock plates will not fit correctly over bolts and retainer plate, tighten the bolt until lock plate can be installed.

2. Install sun gear. For double reduction models: Install the double reduction plate, install two bolts and torque to 220-250 Lb-Ft (298-339 N-m).
3. For two speed models, slide shift fork into carrier housing and position on sun gear. Install shift fork shaft through hole in carrier housing and shift fork.

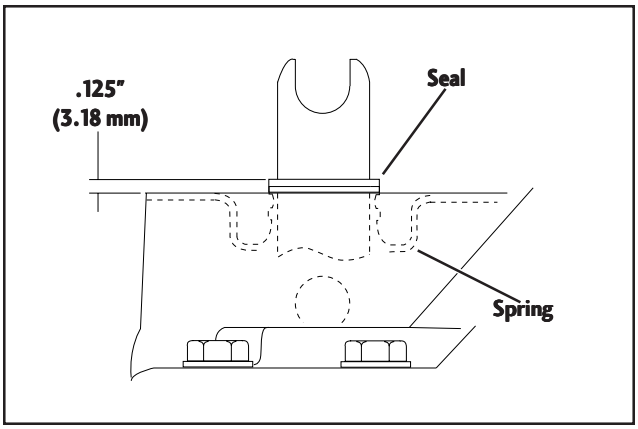


Figure 12

4. Insert and tighten set screw 30-40 Lb-Ft (41-54 N-m).
5. Install shift fork seal and spring. See Figure 12.

Sun Gear Retainer Installation Complete

INSTALLATION OF CARRIER INTO AXLE HOUSING

1. Thoroughly clean the inside of the carrier housing and inspect the housing mounting surface for nicks and general cleanliness. Stone the surface if necessary to remove burrs or nicks.
2. Apply an 1/8" bead of Loctite #518 gasket eliminator onto the axle housing mounting flange and around each bolt hole. See Figure 13.

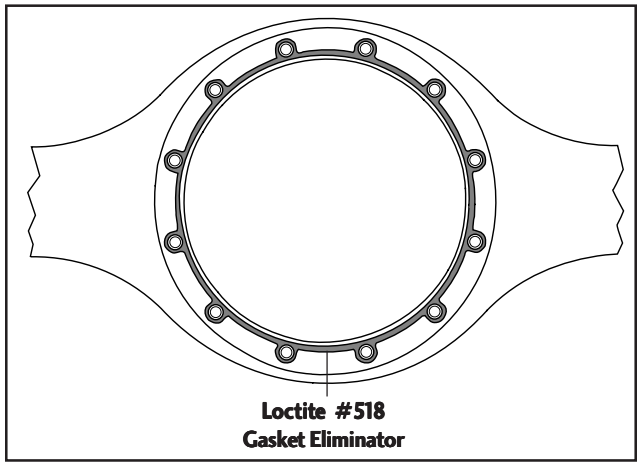
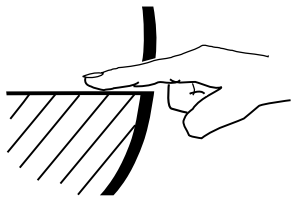


Figure 13

3. Thread 2 studs into the axle housing 180^0 apart. This will eliminate rotation of the carrier assembly after it makes contact with the gasket material.
4. Install the carrier assembly into the axle housing. Clean the mounting bolts, and coat with Loctite #277 (red), or its equivalent, and install. Tighten bolts evenly in cross pattern. See torque specifications for carrier mounting bolts.
5. Allow one hour cure time for gasket material before adding hypoid gear lubricant.
6. Remove the old axle flange gasket and clean mating surfaces of the hub and axle flange.
7. Install the new axle flange gasket.
8. Install the axle shafts to proper location. Torque the axle flange nuts to vehicle manufacturers specifications.
9. Clean drain plug and install. Fill unit to proper level with hypoid gear lubricant.



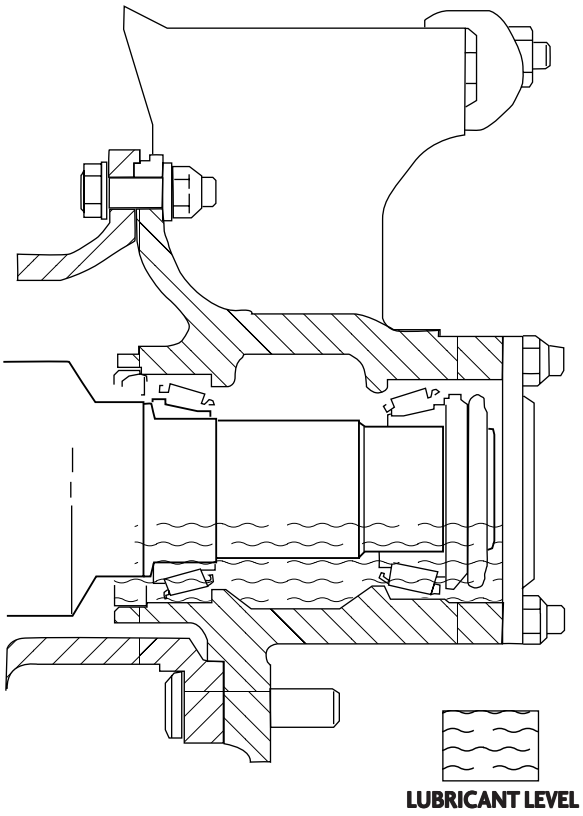
NOTE : Lubricant close enough to bottom of fill hole to be seen or touched is not sufficient. Lubricant must be level with the fill hole.

Installation of Carrier Complete

WHEEL BEARING ADJUSTMENT

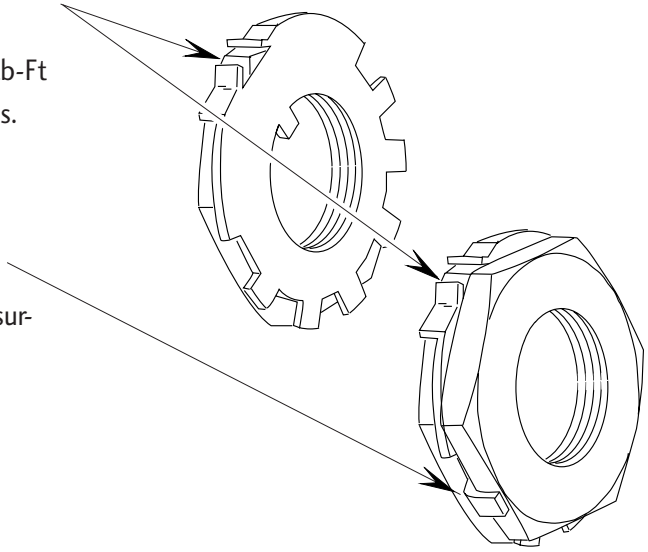
NOTE: Wheel bearings should be adjusted following vehicle manufacturers recommended maintenance schedule.

1. Block wheels not being adjusted to insure that vehicle will not roll. Release emergency brake.
2. Raise wheel to be adjusted off of the ground. Make certain wheel rotates freely.
3. Remove axle shaft.
4. Remove outer adjusting nut and lock if tabs are broken.
5. Torque inner wheel nut to 50 Lb-Ft (68 N-m) while rotating wheel one direction, then the other direction. Back off inner nut 1/4 turn.



NOTE: When replacing wheel bearings, new bearings must be re-seated to insure maximum service reliability. After the hub and bearings are assembled in place on the spindile, install the inner adjusting nut. Tighten the inner adjusting nut to 120 - 140 Lb-Ft (163-190 N-m), while rotating the hub to seat the bearings. Back off the adjusting nut 1/2 turn and follow the proedure outlined in step #5.

6. Install lock against inner wheel nut, with locking portion positioned on either the flat side of inner nut or peak of inner nut, as shown.
7. Install outer wheel nut and torque to 250-275 Lb-Ft (340-373 N-m). Rotate wheel in both directions. Wheel must rotate freely, with out binding.
8. Bend one tang of lock over flat portion of outer wheel to secure.
9. Remove old axle flange gasket and clean mating surfaces of hub and axle flange.
10. Install new axle flange gasket.
11. Install axle shaft. Torque axle nuts to vehicle manufacturers specifications.



Wheel Bearing Adjustment Complete

AXLE/TORQUE SPECIFICATIONS

Axle Specifications

Item	Model	U.S.	Metric
Pinion Bearing Preload*			
Torque Wrench	G, M	20 - 50 Lb-in	2.3 - 5.7 N-m
Differential			
Ring Gear to Pinion Backlash	G, M	.008" - .016"	.20 - .41 mm
Lubrication			
Lube Capacity (Approx.**)	G	25.0 pints	11.8 liters
Lube Capacity (Approx.**)	M	35.0 pints	16.6 liters

** Pinion bearing preload is established prior to installation of pinion seal.*
*** Capacity will vary depending on the housing angle in each vehicle. Fill to lower edge of fill hole in rear of axle housing as shown on Page 22.*

Fasteners

Position	Model	Thread	Grade	Lb-Ft	N-m
Flanged Hex Nut	G, M	1-1/4" - 12		700 - 900	949 - 1,220
Fill & Magnetic Drain Plugs	G, M	3/4" - 14	8	35 - 45	47 - 61
Adjusting Ring Retainer Bolts	G, M	3/8" - 16	8	30 - 40	41 - 54
Differential Case Bolts	G	7/16" - 14	8	115 - 135	156 - 183
	M	1/2" - 13	8	70 - 80	95 - 108
Carrier Mounting Bolts	G	1/2" - 13	8	100 - 120	136 - 163
	M	5/8" - 11	8	240 - 260	325 - 352
Ring Gear Bolts	G	1/2" - 13	8	110 - 125	149 - 169
	M	9/16" - 12	8	160 - 180	217 - 244
Differential Bearing Cap Bolts	G	5/8" - 18	8	220 - 250	298 - 339
	M	3/4" - 16	8	290 - 350	393 - 475
Pinion Pilot Bearing Retainer Bolt	G	7/16" - 14	8	70 - 80	95 - 108
	M	1/2" - 13	8	110 - 125	149 - 169
Sun Gear Retainer Bolt@	G, M	5/8" - 18	8	255 - 275	345 - 373

@ On models equipped with Sun Gear Lock Plate (See Page 27), Retainer Bolt Torque is 220 - 250 Lb-Ft (298 - 339 N-m).

TWO SPEED OPERATING INSTRUCTIONS

The Spicer two-speed rear axle may be specified in combination with four and five speed manual transmissions. There are 8-10 possible gear selections. The axle can be spit shifted or shifted to high when road speed is achieved.

By studying Figure 14 and using the following shift sequences, you can refine and make using the Spicer two-speed axle an automatic occurance.

LOW TO HIGH SHIFTING

- With accelerator down, move the axle selector switch to HI.
- Release accelerator.
- When shift is complete, depress accelerator.

HIGH TO LOW SHIFTING

- With accelerator down, move the axle selector switch to LO.
- Rapidly release and depress accelerator.
- When shift is complete, depress accelerator.

SPLIT SHIFTING THE TRANSMISSION AND AXLE

Upshifting

- While shifting transmission up to the next higher gear,
- Move axle selector switch to LO before engaging clutch.

Downshifting

- With the accelerator down, move the axle selector switch to HI (pre-select).
- Shift transmission down to the next lower gear.

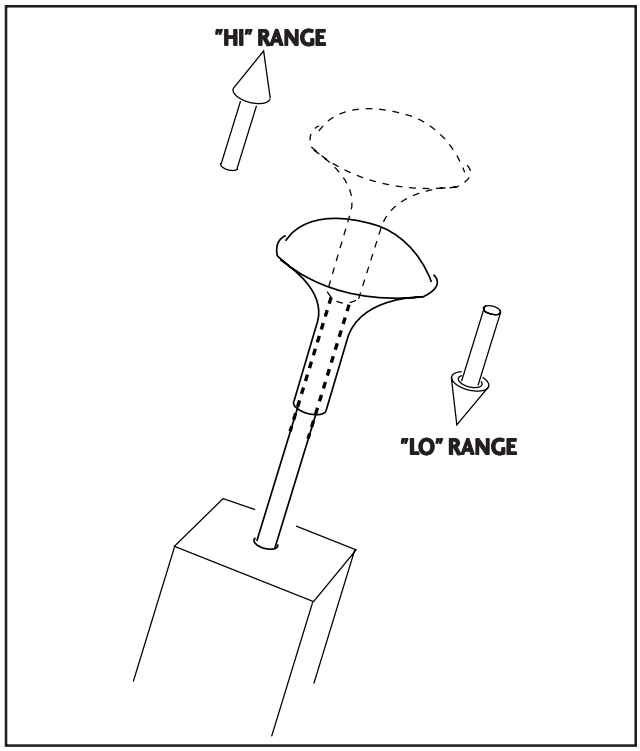


Figure 14

EXPORT IMPROVEMENT FOR M230-T MODEL

RING GEAR BOLT RETAINER INSTALLATION

1. Follow Ring Gear and Support Case Assembly procedures 1 thru 8.
2. Insert ring gear bolts through ring gear bolt retainers. See Figure 15.

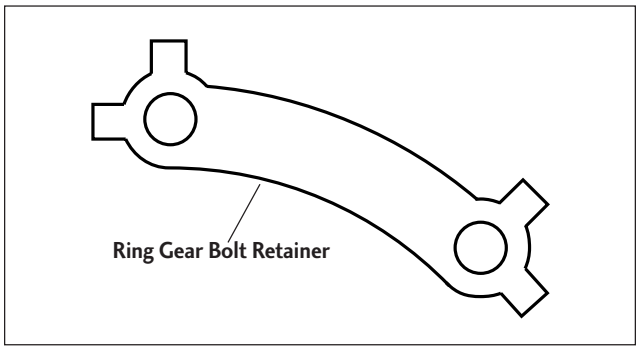


Figure 15

3. Apply a thin layer of Loctite #277 on the threads of the ring gear bolts and install as shown in Figure 16.

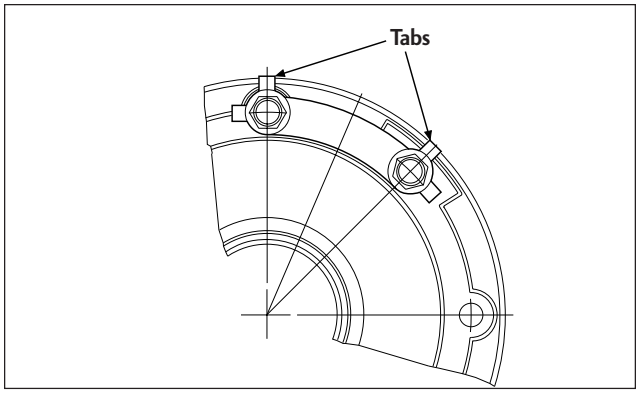


Figure 16

4. Torque the ring gear bolts to 160-180 Lb-Ft (217-244 N-m).
5. Bend tabs on retainers over flats of bolts. See Figure 17.

CAUTION: If tabs on retainers do not align with flats on bolts, tighten bolts to next flat that will align with tab.

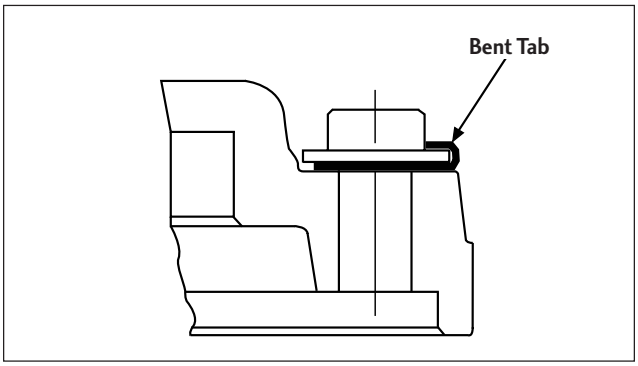


Figure 17

NOTE: Continue assembly with Differential Support Case Installation procedures outlined on Pg. 20.

Ring Gear and Support Case Assembly Complete

SUN GEAR RETAINER INSTALLATION

1. Install sun gear retainer plate. Apply Loctite #277 to threads of bolts with a grooved head and install. Torque bolts to 220-250 Lb-Ft (238-339 N-m).

NOTE: Figures 18, 19 for proper assembly.

2. Install sun gear lock plates over bolts.

NOTE: If lock plates will not fit correctly over bolts and retainer plate, tighten the bolt until lock plate can be installed.

3. Install E-clips to grove in head of bolt.
4. Install sun gear.
5. Slide shift fork into carrier housing and position on sun gear. Install shift fork shaft through hole in carrier housing and shift fork.
6. Insert and tighten set screw 30-40 Lb-Ft (41-54 N-m).
7. Install shift fork seal and spring.

NOTE: Continue assembly with Installation of Carrier into Axle Housing procedures outlined on Pg. 22.

Sun Gear Retainer Installation Complete

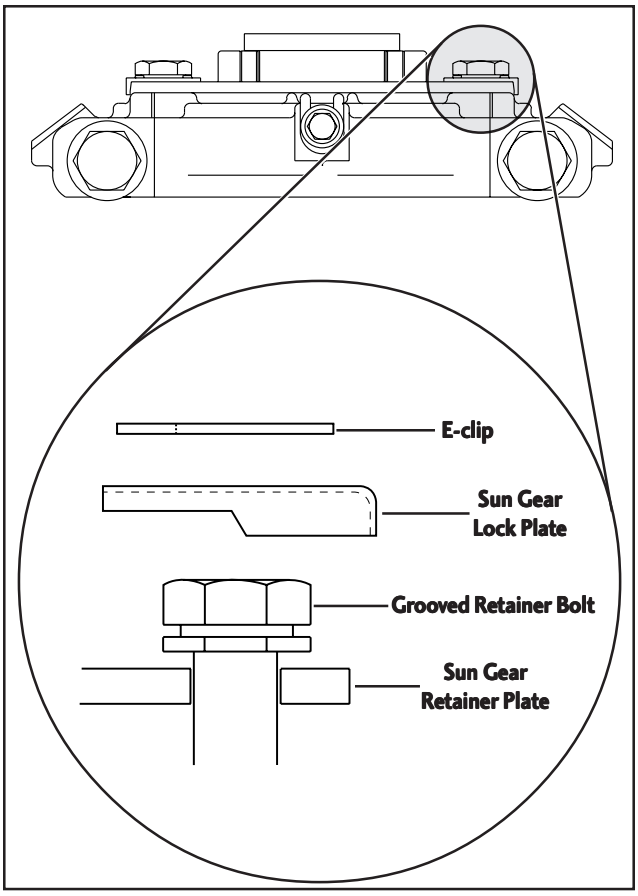


Figure 18

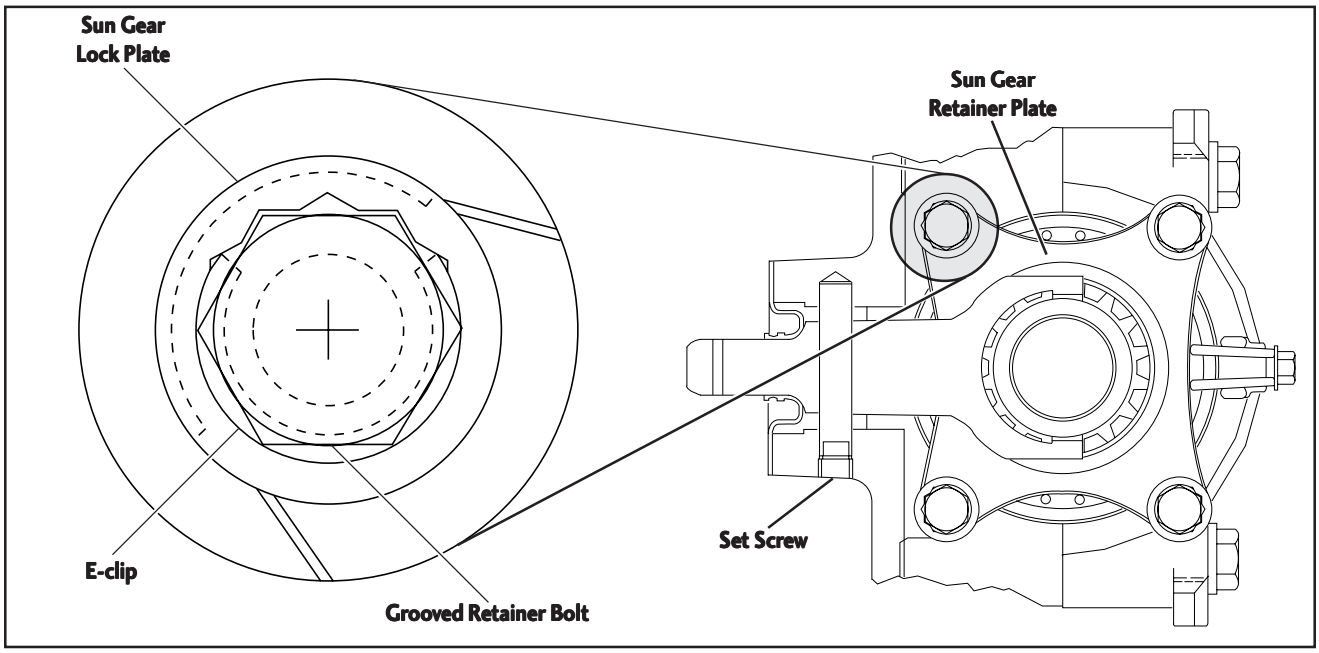
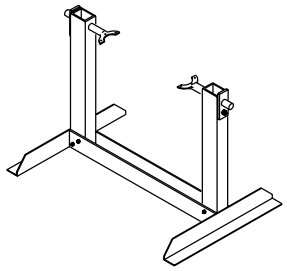
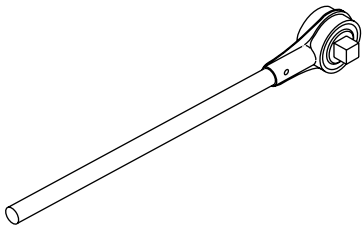
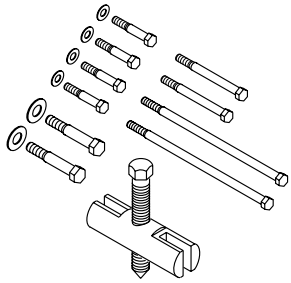
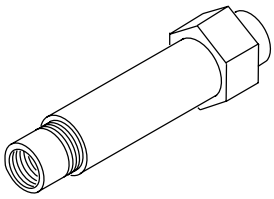
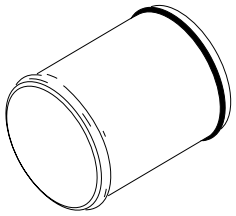
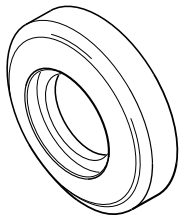


Figure 19

RECOMMENDED SERVICE TOOLS

ORDER NUMBER	ILLUSTRATION	DESCRIPTION
DST1001		CARRIER STAND
DST1002 DST1003 DST1004 DST1005		TORQUE MULTIPLIERS Maximum 1,000 ft-lbs Maximum 2,000 ft-lbs Maximum 4,000 ft-lbs Maximum 12,000 ft-lbs
DST1006		YOKE REMOVER, BAR TYPE
DST1009		INSTALLER, DIFFERENTIAL YOKE ($1\,^{1/4}$"-12)

RECOMMENDED SERVICE TOOLS

ORDER NUMBER	ILLUSTRATION	DESCRIPTION
DST1000-1		SEAL INSTALLATION TUBE HANDLE
DST1000-2		PINION SEAL INSTALLER

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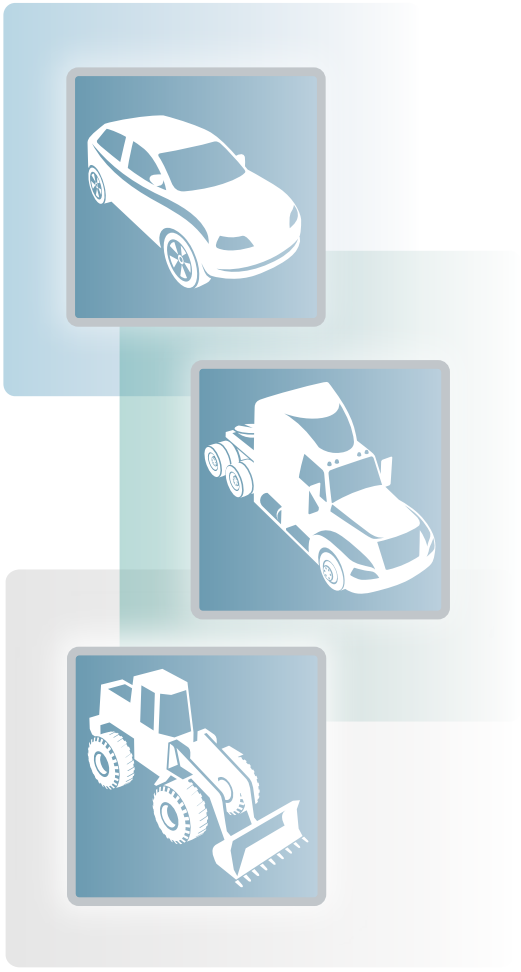

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